Leadership – Essential for Developing the Discipline of Statistical Engineering

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With Significant Contributions by
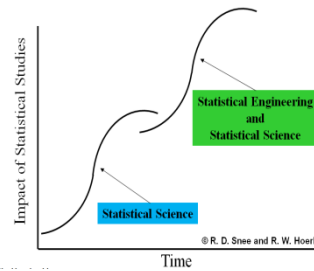Roger Hoerl
GE Global Research

NASA Symposium on Statistical Engineering
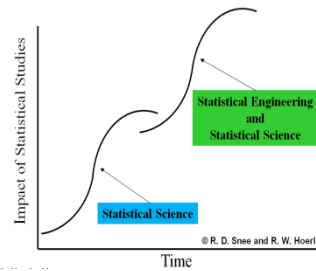
Williamsburg, VA

May 3-5, 2011

Agenda

- Today's Realities
- Increasing the Impact of our Work
- Dealing with Large, Unstructured, Complex Problems
- Why Leadership is Needed
  - What Does Management Expect of Statisticians and other professionals?
- What Do Leaders Do?
- Developing Leadership Skills
- Conclusion

Today's Realities

- Global Competition, fueled by information technology, is forcing changes in all aspects of our society
    - Business
    - Government
    - Education
    - Health Care
- Customers are demanding more
- We have to change how we work and manage
    - All aspects of our organizations
    - All processes we use to do our work

# Implications for Use of Statistical Thinking and Methods
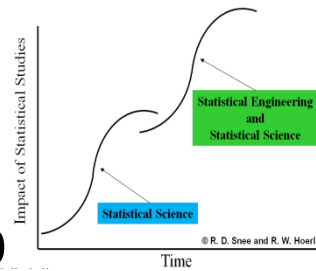
- Internet enables communication and data access available to anyone in the world at any time.

- Anyone with a PC can download and use statistical software

- Cost conscious organizations are asking why employees can't analyze their own data

- Narrow technical tasks, such as intensive data analysis, are easy to transfer to employees in low cost countries*

- The "market" for the old role of a consultant who performs data analysis is rapidly evaporating.

Organizational Leaders Are Looking for People Who Can Deliver High Impact Results

*We do not suggest that this controversial phenomenon is either good or bad; only that it is occurring.

Expanding Role of Statisticians
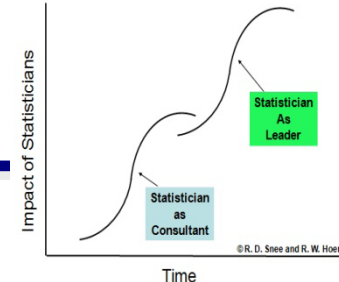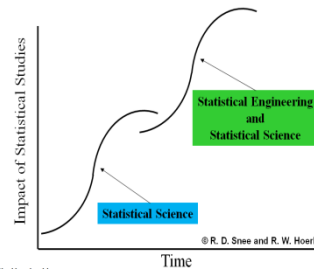

Consultant/Expert

- Consult on other people's projects
- Perform routine analyses if needed
- Teach statistical tools
- Work with technical people

- Narrow expertise and accountability
- "Benign neglect"

Collaborator/Leader

- Lead or collaborate on our own projects – project ownership
- Focus on significant, complex problems
- Design training systems
- Work with managers and technical people
- Broad expertise and accountability
- "In the firing line"

Computer Scientists Provide an Example of Such a Role

Statistical Engineering Is A Team Sport

Management and Organizational Leaders
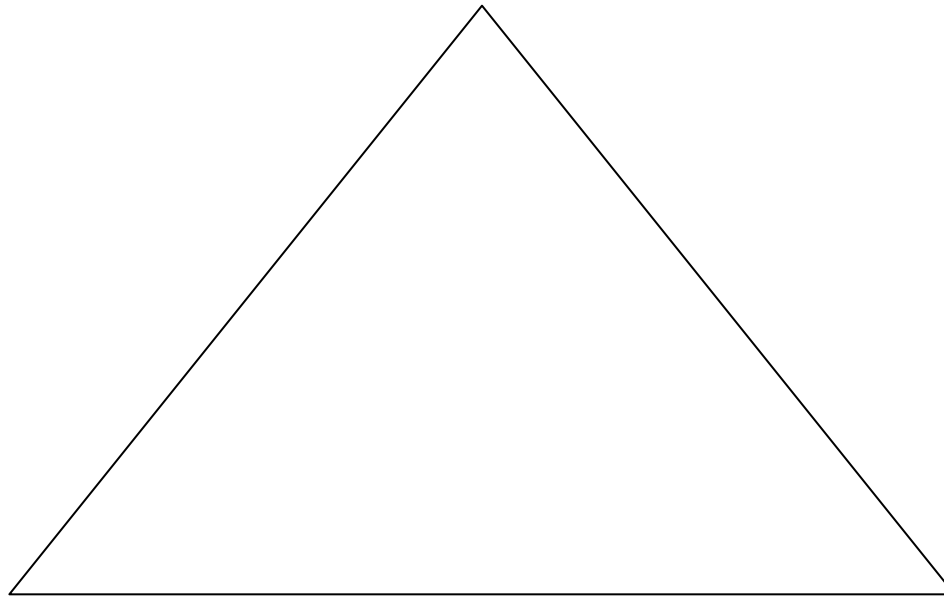
Statisticians

Scientists, Engineers and Other Professionals

Statistical Engineering Increases Impact

Balanced approach involving both statistical science and statistical engineering will enable us to have a much broader impact on society

Statistical Engineering and Statistical Science

Statistical Science

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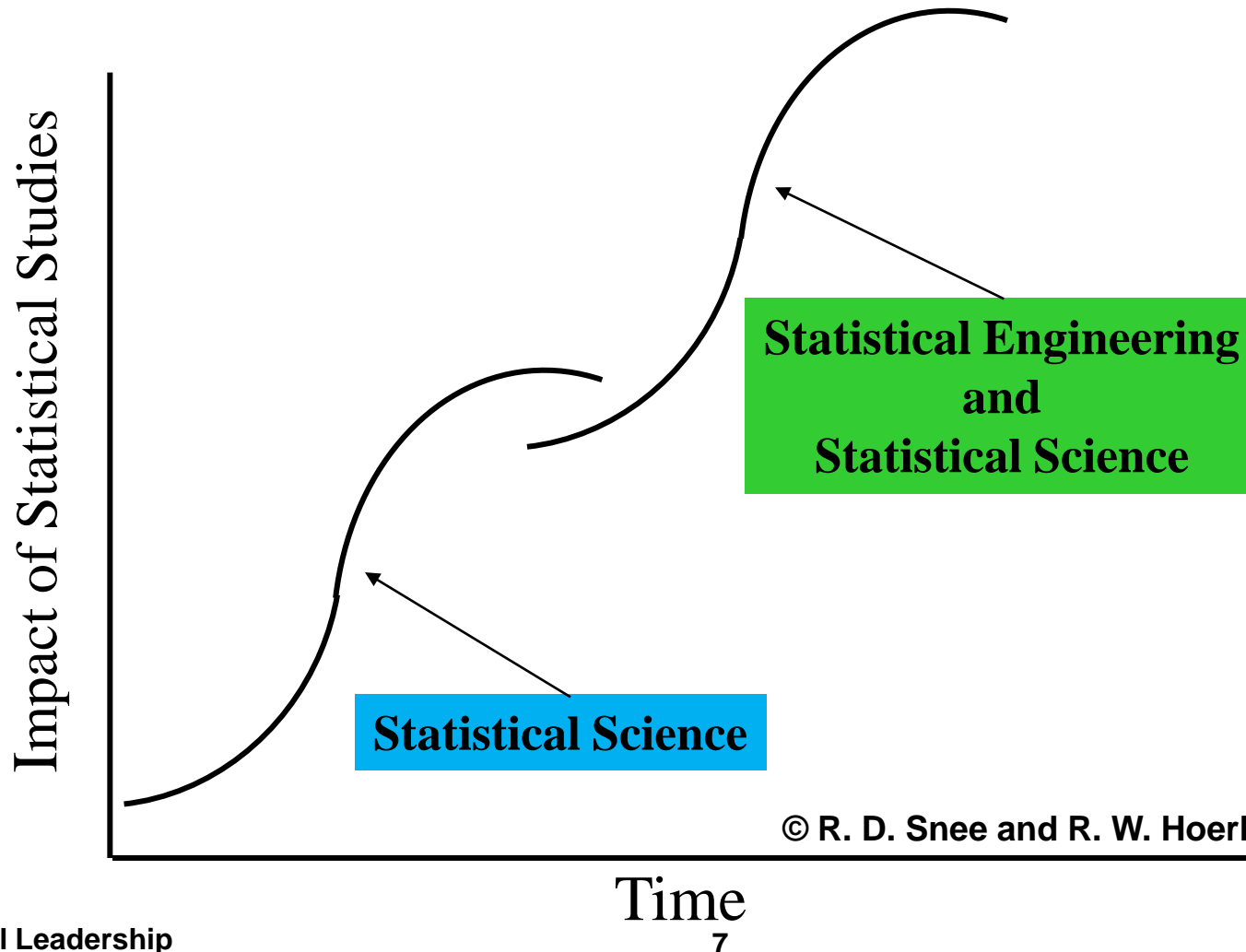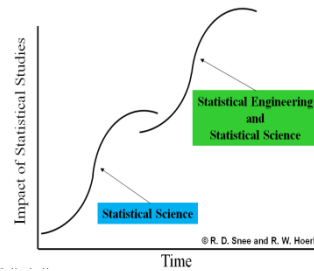
Case Study – Product Quality Management
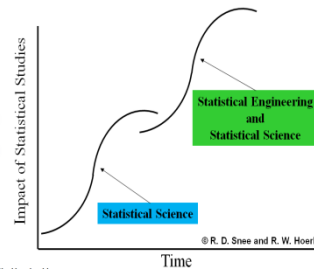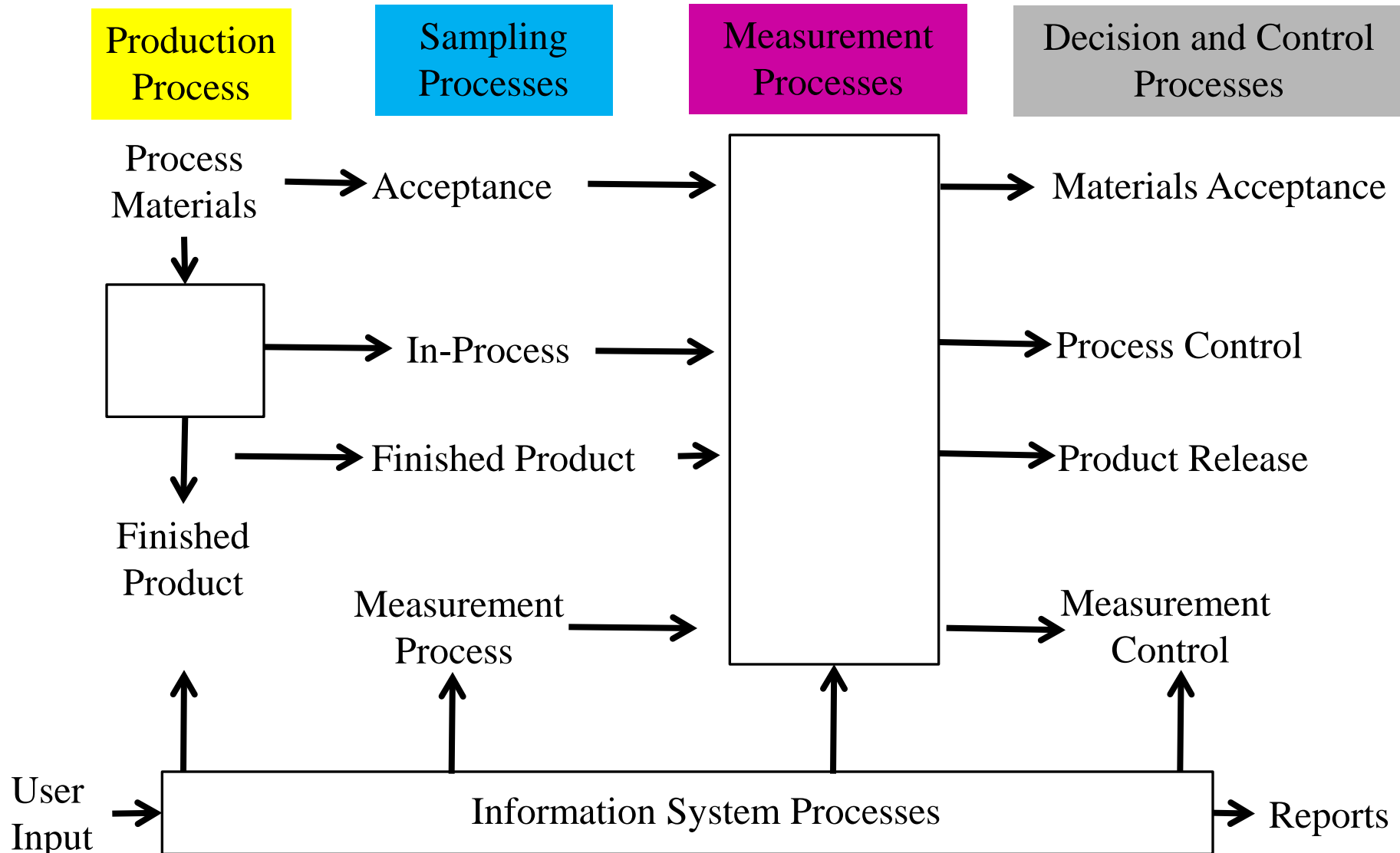
- Background
  - DuPont Dacron polyester products experiencing quality problems in the marketplace
  - Products produced at 8 plants globally
  - Key players – Manufacturing and Marketing – not working together
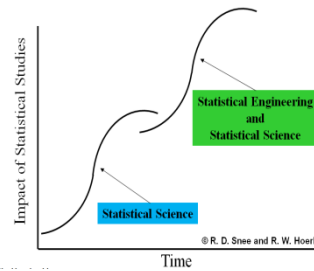 - Many quality and statistical tools are available to solve this problem
- Questions
  - Is this an opportunity with major impact?
  - Is this a large, unstructured, complex problem?
  - What is needed to be successful?

PQM System

| Production Process | Sampling Processes | Measurement Processes | Decision and Control Processes |

Process Materials → Acceptance → → Materials Acceptance

In-Process → → Process Control

Finished Product → → Product Release

Finished Product

Measurement Process → → Measurement Control

User Input → Information System Processes → Reports

- Product Release
  - Sampling Schemes
- Process Control
  - Cumulative Sum
- Measurement Variation
  - Shewhart and CUSUM Control charts
  - Inter-laboratory studies
- Process Calibration and Adjustment
  - Response Surface Methods
- Process Variance Components - Estimation and maintenance

Statistical Techniques Were Integrated, Linked and Sequenced to Produce the Product Quality Management System

DuPont PQM: Statistically-Based Product Quality Management System

- Product Quality Management (PQM)

  - Framework for managing the quality of a product or service.

  - Operational system the enables Marketing, R&D, Production and support personnel to work together to meet increasingly stringent customer requirements

- "Within two years product quality had improved to the point of commanding a marketplace advantage and more than $30 million had been gained in operating cost improvements. The statistically based Product Quality Management system developed for "Dacron" was expanded to other products with further contributions in earnings."

Richard E. Heckert
Chairman and CEO, DuPont Company
ASA Annual Meeting 1986
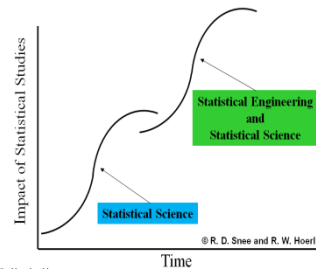
Large, Unstructured, Complex Problems
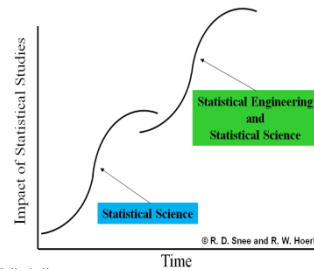
- The big payoff, mission critical problems

- Impact is broad

  - Process performance, financial, customer, social and environmental

- Several departments, groups and functions and disciplines are involved

- Problem has high degree of complexity

  - Technical and non-technical challenges are involved

- Multiple sources of data and information are used

- Mix of statistical and non-statistical techniques are required for solution

- Creative use of information technology is needed for success

- Long-term successes requires embedding solution into work processes

**Statistical Engineering is Needed for Such Problems
Huge Opportunity for All Involved**

Case Study
Product Quality Management System

Role of Statisticians in PQM at DuPont

- Leaders in developing their organization's strategy for quality management

- Leaders in developing technology systems for quality management

- Participants in the business planning process

- Participants in problem solving activities

- Leaders in initiating and implementing quality management training systems at all levels

DuPont PQM Manual 1988

What Do Executives Expect?
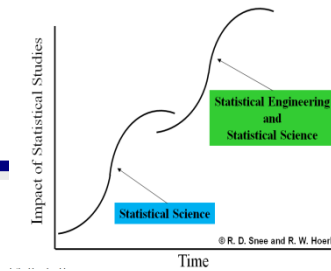
Executives Interviewed (Vining, Bowen and Parr 2001)

- CEO, Major Technology Co., #1
- CEO, Major Service Company
- Senior VP, Major Manufacturing Co.
- VP, R&D, Major Food Company
- VP, Major Technology Co., #2
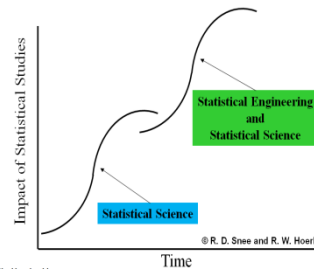- VP and GM, Major Manufacturing Co.

Executives Expectations

- Persons Who Can Lead Projects and Get Results

"Results Buy Freedom"

Arnie Eckleman,
Senior Vice President
Verizon Communications
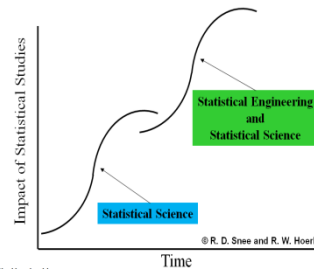
Developing Leadership Skills

Some Questions You May Have

- What is Leadership?

- What Do Leaders Do?

- Key Leadership Skills?

- How do I develop leadership skills?

Leaders Help Us Make the Needed Changes?

Leaders help a group of people move from
    One paradigm to another

"Leadership: the art of getting someone else to do something you want done because he wants to do it."
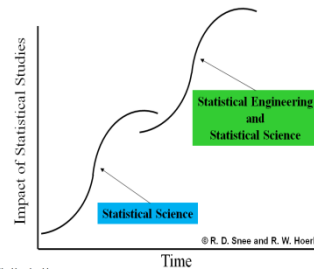
Dwight D. Eisenhower

"Leaders have followers"

Bill Gore, Founder
W. L. Gore and Associates
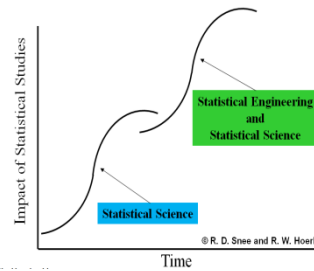
We have Many Kinds of Leaders

- Political
- Military
- Business
- Academic
- Religious
- Sports
- Statistical Leaders
    - Technical
    - Managerial
- And many more
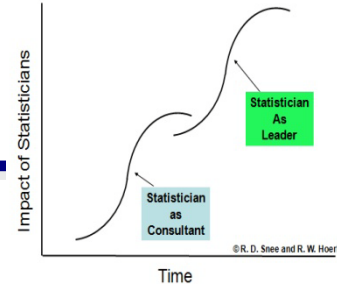   . . . .

Myths of Leadership

- Leadership is a rare skill
- Leaders are born not made
- Leaders are charismatic
- Leadership exists only at the top of an organization
- The leader controls, directs, prods, manipulates

Bennis and Nanus 1985
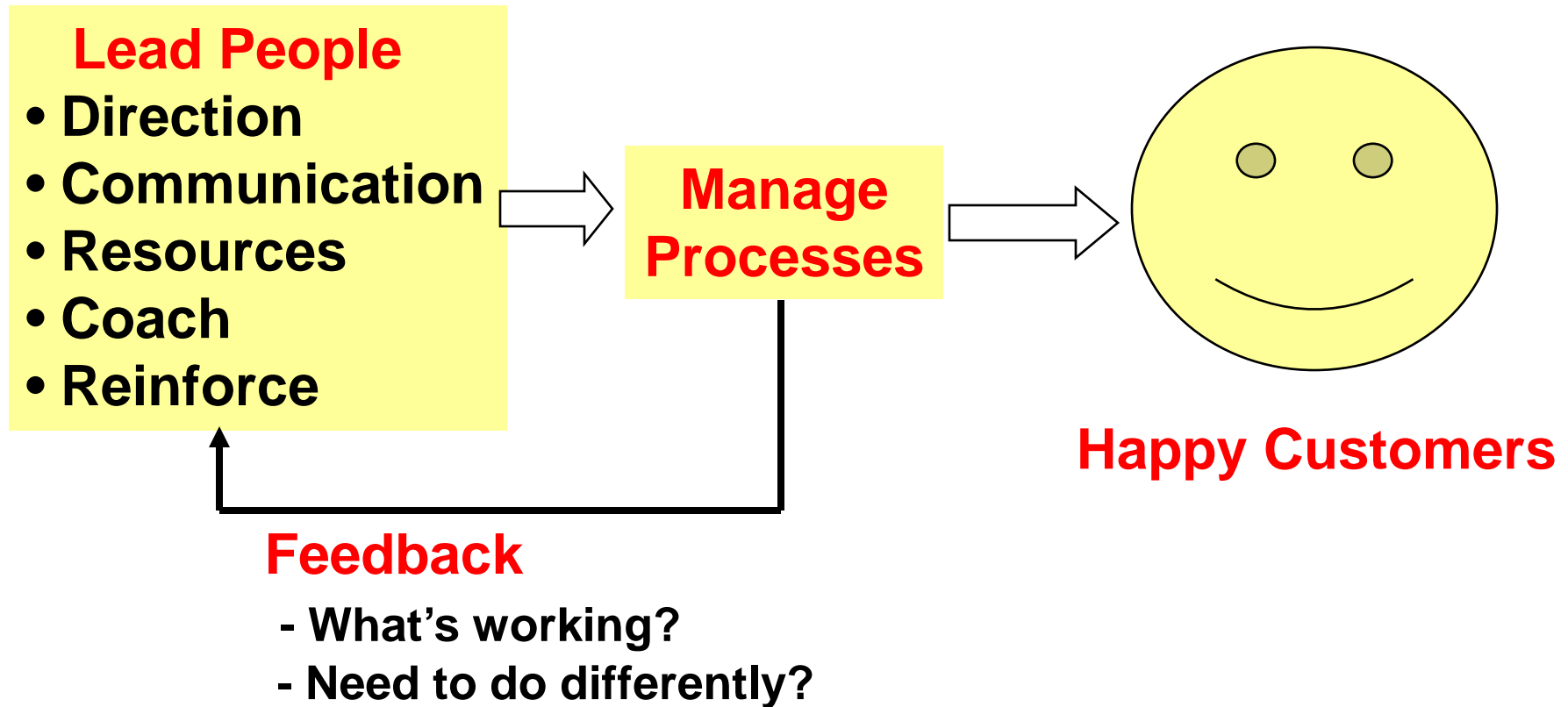
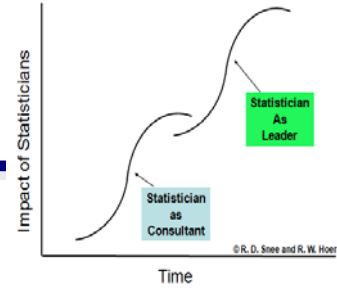# Change Requires Both Leading and Managing

Leading

- Moving Between Paradigms
- Doing Right Things
- Creating Improvements
- Leading & Developing People

Managing

- Working Within a Paradigm
- Doing Things Right
- Holding the Gains
- Managing Processes

We Need Both Leading and Managing

Lead People
- **Direction**
- **Communication**
- **Resources**
- **Coach**
- **Reinforce**

→ **Manage Processes** →

Happy Customers

Feedback
- **What's working?**
- **Need to do differently?**

Healthy processes serving happy customers

Time Spent on Doing and Improving Work
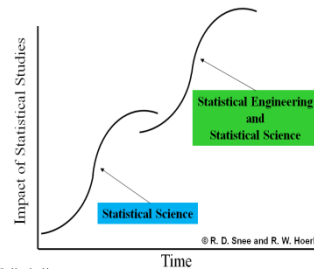
Role	Leading "Improving" Work	Managing "Doing" Work
Executives	90	10
Managers	70	30
Others	30	70

So What Do Leaders Do?

Provide Direction
Where We're Headed

Recognize and Reinforce Results and Desired Behavior

Communicate What and Why

Enable, Coach and Counsel Training, Resources, Support
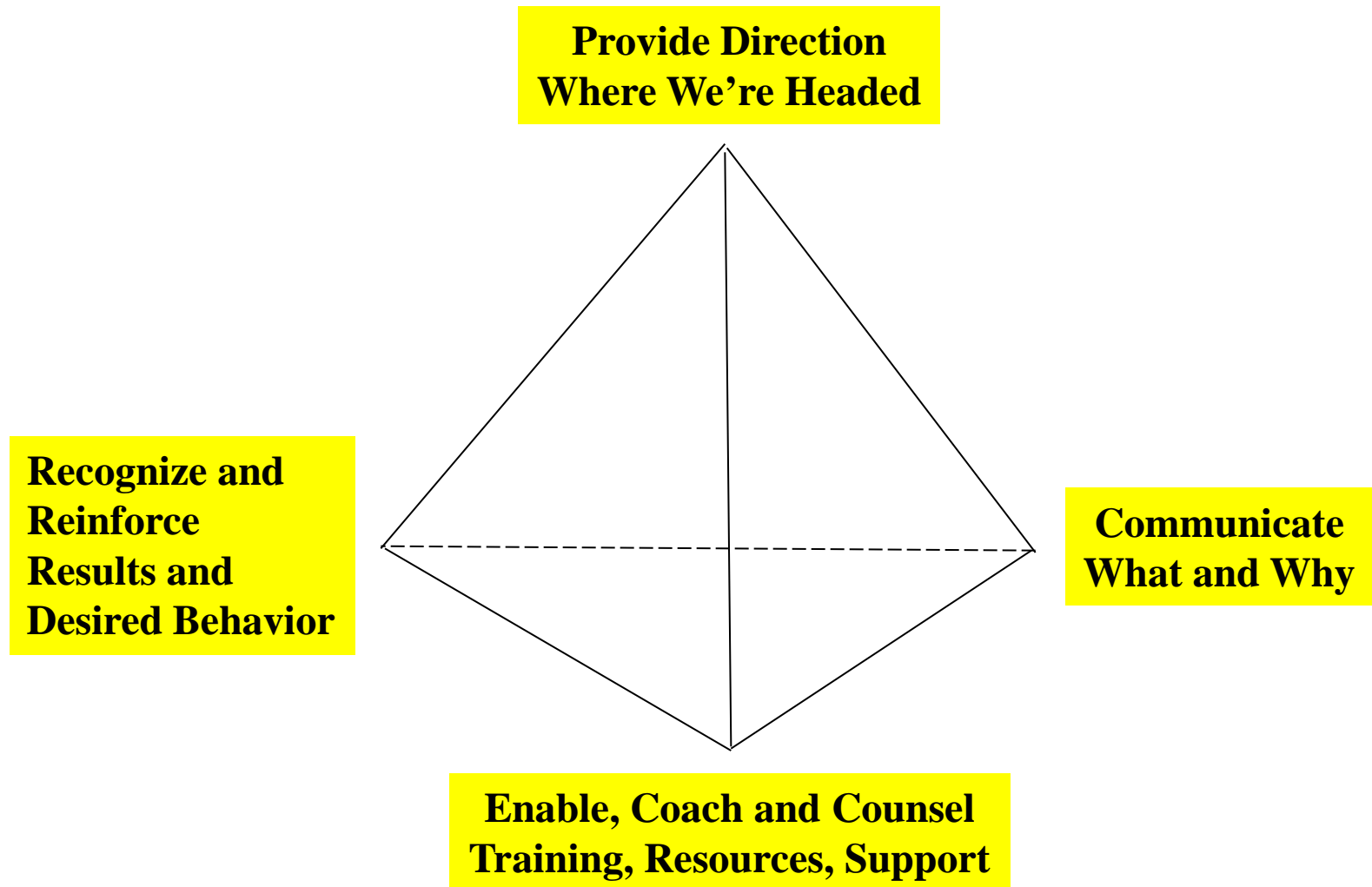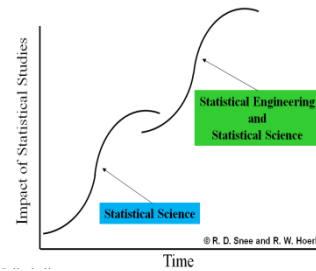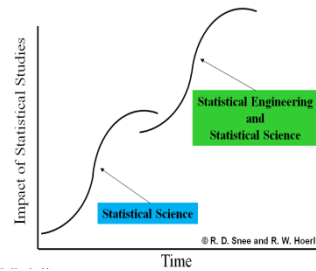
Providing Direction - Showing the Way

- Vision - What Success Looks Like

- Objectives - How we will win

- Goals - How much, by when

- Strategies - What we will focus on

- Initiatives - Specific projects we will undertake
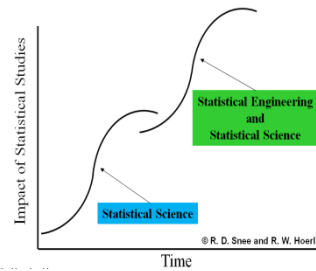
Kotter's Eight Stages of Successful Change

- Establish a sense of urgency
- Create a guiding coalition
- Develop a vision and strategy
- Communicate the change vision
- Empower employees for broad based action
- Generate short-term wins
- Consolidate gains and produce more change
- Anchor new approaches in the culture

Communicate The Direction
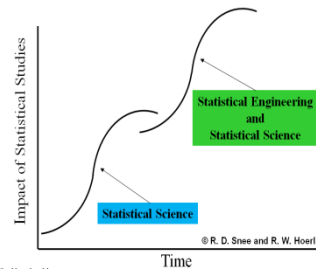## Provide Understanding and Hope

- 🔴 The direction we are pursuing
- 🔴 What benefits we expect to get
- 🔴 Progress - Results achieved to date
- 🔴 Communication should be clear, concise and continuous
- 🔴 Variety of media should be used
    - People take in and process information in different ways
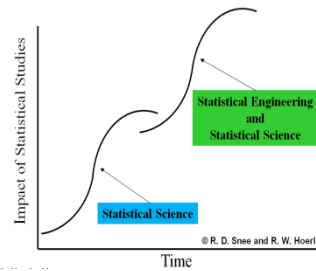
Enable - Set Up People for Success

- Provide resources - people, time, $$$
- Provide training - build needed skills
- Provide methods to accomplish assigned tasks
- Remove barriers
- Coach and Counsel

# Recognize and Reinforce –
Catch People Doing Things Right

- Recognize accomplishments and results
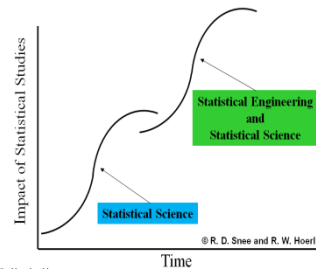 - Psychological rewards
  - Financial rewards
- Reinforce desired behavior
  - Catch people doing things right
- People want and need feedback
  - "How am I doing?" , Ed Koch, Mayor, New York
- Feedback needed for improvement
- Key tool - Management reviews

Show the Way

Catch People Doing Things Right

Develop Understanding and Hope

Set People Up for Success
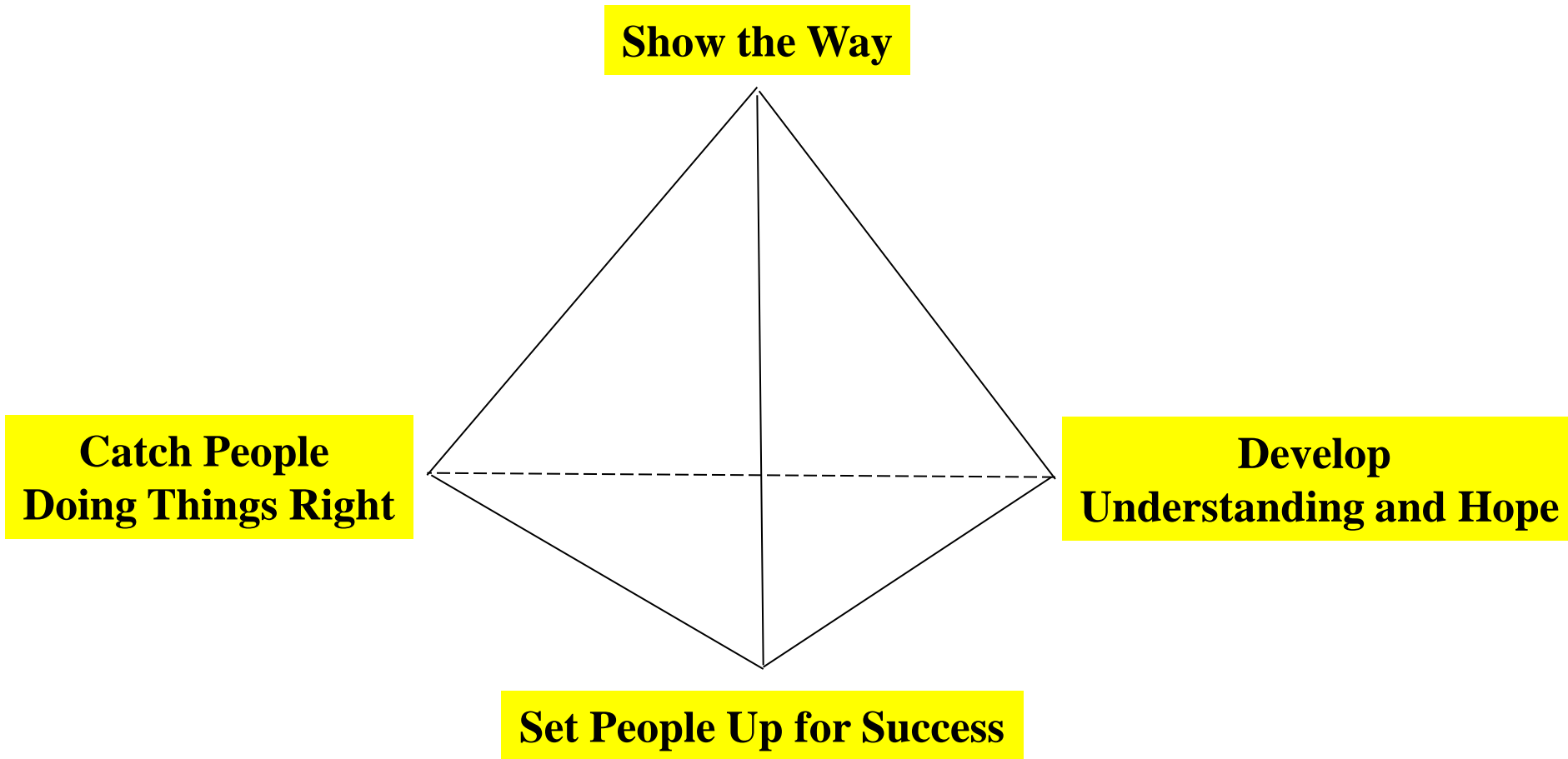
Critical Leadership Skills

- **Organizational Acumen**
    - **– Understand how the organization works**
- Process and Systems Thinking
- Strategic Planning and Deployment
- Stakeholder Building
- Communication – Clear, concise and continuous
- Reviewing and Coaching
- Structured Improvement Methods (DMAIC)
- Learn to Deal With Teams and Group Dynamics
- Meeting Design and Facilitation
- Project Planning and Management
- Understanding Human Behavior
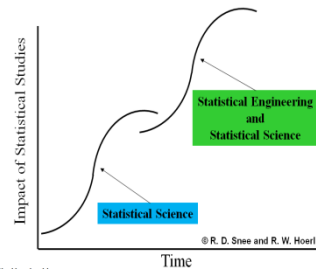
Ways to Develop Leadership Skills

- Read books and articles
- Attend courses
- Discuss the subject with colleagues
- Practice, Practice, Practice, ………..

**"Becoming a leader is like
learning to play the violin in public"**

Anonymous

- Place an increased focus on enhancing your leadership skills
- Be on the lookout for examples - good and bad - of leadership that you can use as a model
- Personal Change Is Required
  - Those Who Fail to Respond to Their Changing World Will Have Less Influence in It
- Best way to learn to lead is to do it
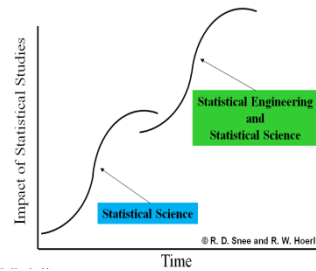 - Be on the lookout for *your opportunity*!

Can We Be Successful?
"Never doubt that a small group of committed people can change the World. Indeed, it is the only thing that ever has"

Margaret Mead

Books on Leadership

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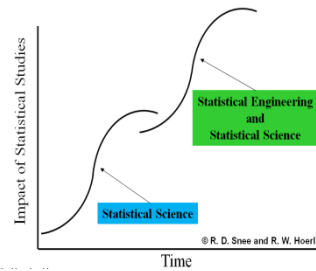
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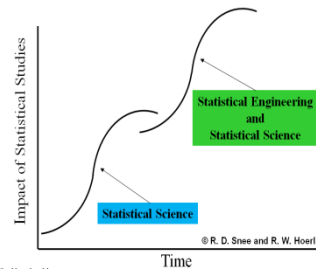
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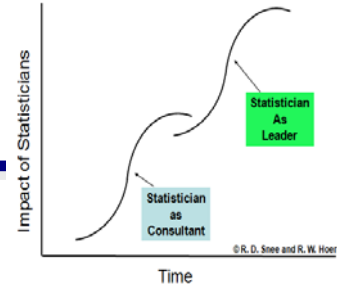
Questions and Comments?

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